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ABSTRACT

This booklet consists of five sample lessons integrating population education into mathematics instruction. It is one of four in a series. Materials differ from those in an earlier series (1980) in that lessons are presented at the secondary level only; there is no duplication of lessons from the earlier series in content and teaching strategies. Lessons are not only aimed at developing skills in applying addition, multiplication, their inverse operations, computing rates, arithmetical means, and average, but also are aimed at developing knowledge about various population concepts. Thus, addition, multiplication, and their inverse operations are used for computing sex ratio, population change, fertility rate, rate of natural increase, migration rate, and growth rate. A lesson teaching the construction of a frequency table using data on family size is followed by a lesson relating dependency ratios to population composition. In a final lesson, percentage is used to solve problems related to population projection and doubling time (the number of years it takes for a population to double itself). Each lesson contains a box which provides the user with information on content, objectives, grade level, and subject into which population education should be integrated. Although the main body of each lesson varies, in most cases lessons contain a narrative of the content and some evaluation questions at the end. Lessons were adapted from materials derived from Malaysia and the Philippines. (LH)

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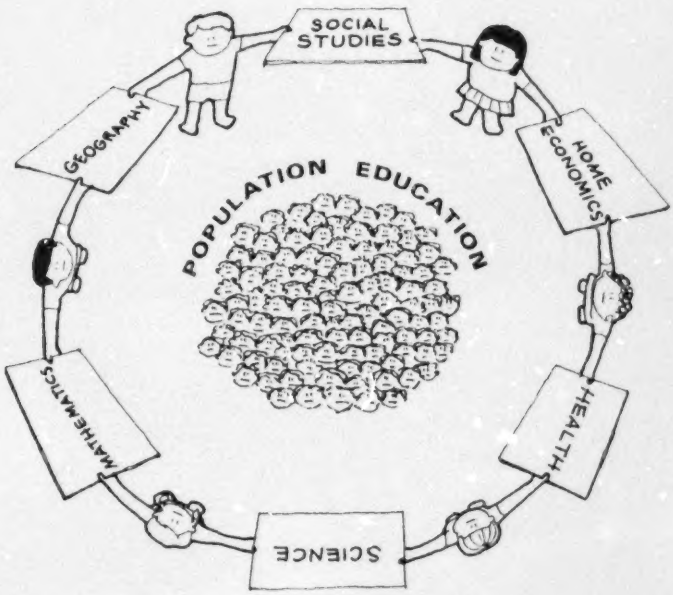
population education in MATHEMATICS

some sample lessons for the secondary level



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POPULATION EDUCATION IN MATHEMATICS

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INTRODUCTION

This booklet consisting of sample lessons integrating population education into mathematics, is one of the four in a series prepared to provide more innovative lessons in addition to the six booklets developed and disseminated in 1980. First conceived to provide teachers, educators and curriculum developers with useful tools for disseminating population education concepts in the school setting, the first six booklets consisted of sample lessons integrating population education concepts into social studies, health, mathematics, science, home economics and geography which are taught at the primary and secondary levels. While the 1980 booklets contained lessons for use at both primary and secondary levels, the present set of four booklets consists of sample lessons introducing population concepts into selected subjects (social studies, science, mathematics, and home economics) for use at the *secondary level* only. The main reason for this focus is that more and more countries in Asia are introducing population education at the secondary rather than the primary level. Many of them, whether they have new or on-going population education programmes have developed a wider range of lessons and learning materials for secondary courses - many of which are in their respective national languages.

Compared with the past, more and more population education programmes are at present paying closer attention and devoting more time to the development of curriculum materials in population education. Integrating population education concepts into various subject areas is not as easy as it might seem. Although a number of content analyses of school textbooks have shown that population education concepts already exist in these materials, they are more there by accident than by design. Some programmes on the other hand go to the other extreme. In their case, too many population education concepts are introduced into the subjects, overburdening the curriculum material and thus overwhelming the teacher with an extra teaching load. This naturally results in the rejection of the population education concepts and gives little chance for their acceptance as a built-in enrichment area for the total general curriculum programme.

Thus the primary objective of this series of curriculum materials is to provide a continuous stream of exemplary lessons and learning materials showing the various techniques and

strategies that different countries have taken to integrate population education concepts into various subjects taught in the school. Hopefully, a regular updating of these booklets will show a trend in the efforts of the countries to finally adapt a strategy that will ensure a proper integration of these concepts, not in a skeletal and unsystematic manner nor in an overwhelming and saturating sense either, but in an adequate quantum that will meet the acceptable minimum learning requirements called for in this field.

Organization of this booklet

'Population Education in Mathematics' consists of five sample lessons integrating population education into mathematics. The sample lessons included in this booklet are a combination of original materials and an adaptation of lessons derived from Malaysia and the Philippines and some original materials developed by the Unesco staff. The selection of sample lessons is first of all based on the criterion that they should not duplicate those found in the 1980 booklets in terms of content and treatment or teaching strategy. Secondly, they should offer new techniques in the development of population education concepts. In cases where the lessons contained good and appropriate concepts but the development and treatment was not carefully executed, considerable adaptations have been made.

Each lesson contains a box which provides the user with initial information with regard to content, objectives, grade level and subject into which it should be integrated. The main body of each lesson varies. For example, at its simplest form, some lessons contain a straight narrative exposition of the content and some evaluation questions at the end. The second type consists of lessons which carry an overview, content, teaching-learning strategies and evaluation but are given in an outline form, enumerating a list of alternative contents, teaching-learning strategies and assessment questions. The more detailed type of sample lessons contain: (a) an overview or introduction; (b) a suggested teaching materials and references, concretely showing how these teaching aids can be used; (c) the development of the concepts which give specific step-by-step procedures to the teacher on how to expand on the subject, what alternative activities to undertake to achieve these objectives, what reactions to expect from the students and alternative ways of dealing with these reactions; (d) a summary of what has been learned in the lesson; and finally (e) a complete set of evaluation questions to determine the students' gain in knowledge and change in attitude and skills.

Contents

Mathematics at the secondary level deals with more sophisticated computing operations and the five lessons under this subject

area focus on these. The lessons are not only aimed at developing skills in applying addition, multiplication, their inverse operations, computing rates, arithmetical means and average but are also aimed at developing knowledge about the various population concepts. Thus, addition, multiplication and their inverse operations are used for computing sex ratio, population change, fertility rate, rate of natural increase, migration rate and growth rate. Percentage is also used to solve problems related to population projection and doubling time. Finally, one lesson also teaches the construction of a frequency table using data on family size.

Contribution from the member states

There are many more examples of population education lessons which had not been included in this booklet for the simple reason that they come in the countries' national languages. Hopefully, these few lessons should generate more contributions from the member states by providing us with translated lessons which they think can be of great use to other countries.

CONTENT	:	SEX RATIO AND MASCULINITY RATIO
OBJECTIVE	:	*To become familiar with the application of addition and multiplication and their inverse operations in computing sex ratio and masculinity ratio.*
GRADE LEVEL:		LOWER HIGH SCHOOL
SUBJECT	:	MATHEMATICS

A. Opener: Content

1. What is sex ratio?

Sex ratio is a measure of the sex composition of a population. It is the number of males per 100 females. The sex ratio for a population is calculated as follows:

$$\text{Sex ratio} = \frac{\text{Number of males}}{\text{Number of females}} \times 100$$

Thus, a sex ratio of 100 indicates that the number of males is equal to the number of females. A sex ratio higher than 100 indicates a larger proportion of males than females and a sex ratio lower than 100 indicates a majority of females. We can also calculate the sex ratio for each age group.

Using the formula given above, find the sex ratio for the following provinces of the People's Republic of China in 1980 and complete the table.

Province	Population of Both Sexes	Number of Males	Number of Females	Sex Ratio
Beijing	9,230,687	4,670,510	4,560,177	
Tianjin	7,764,141	3,942,043	3,822,098	
Hebei	53,005,875	27,128,903	25,876,972	
Shanxi	25,291,389	13,162,702	12,128,687	
Inner Mongolia	19,274,279	10,053,501	9,220,778	
Liaoning	35,721,693	18,224,680	17,497,013	
Jilin	22,560,053	11,554,694	11,005,359	
Heilongjiang	32,665,546	16,722,562	15,942,984	
Shanghai	11,859,748	5,909,965	5,949,783	
Jiangsu	60,521,114	30,767,366	29,753,748	
Zhejiang	38,884,603	20,166,892	18,717,711	
Anhui	49,665,724	25,763,440	23,902,284	
Fujian	25,873,259 (25,931,106)	13,308,813	12,564,446	
Jiangxi	33,184,827	17,114,961	16,069,866	
Shandong	74,419,054	37,737,424	36,681,630	

Source: *The 1982 Population Census of the People's Republic of China*

Sex ratio

Consider the following table for sex ratio by age of selected nations, 1970.

Age	Philippines	Peru	Rep. of Korea	Morocco	United States	Japan
All ages	99	101.0	101.0	100.0	95.0	96.6
0-4	108	103.2	103.1	100.3	103.8	106.3
5-9	107	102.6	103.2	100.1	103.9	104.0
10-14	104	102.5	105.3	100.3	103.8	103.6
15-19	89	102.6	107.9	100.1	102.1	103.5
20-24	88	102.3	109.6	99.6	193.7	101.7
25-29	98	102.0	106.5	99.8	96.3	98.1
30-34	102	101.8	100.7	100.3		98.5
35-39	105	101.6	89.3	102.3	94.7	100.5
40-44	97	101.1	89.5	101.9		99.4
45-49	90	100.1	96.0	100.8		83.8
50-54	88	98.0	100.0	99.5		81.5
55-59	91	95.8	97.2	97.9	91.5	85.6
60-64	94	93.1	94.5	94.1	87.7	89.6
65-69	95	90.3	82.3	92.0		88.6
70-74	106	87.2	74.2	89.1		82.3
75-79	95	83.2	65.7			72.0
80-84	89	77.4	60.6	80.2	64.0	59.0
85 and over		68.3	56.4			42.0

Source: *United Nations Demographic Yearbook, 1970.*

1. Write the names of the countries in the above table vertically with the corresponding sex ratios for all ages arranged in descending order. Which country has the highest sex ratio? Which has the lowest?

2. Arrange the age groups for each country according to sex ratios in ascending order. Encircle the age group with the highest sex ratio for each country. Enclose the age groups with the lowest sex ratio, in parenthesis for each country.

3. Considering the sex ratios for all ages, what is the tendency of population with respect to number of males and females?

4. What sex is predominant among new born babies, in general? (See ages 0-4).

5. Throughout life, which have higher death rates, males or females? Why do you think so? How will this affect the sex ratio?

6. After what age does the number of males drop steeply?

2. What is the masculinity ratio?

The masculinity ratio indicates the number of males per 100 population. It is calculated by applying the following formula:

$$\text{Masculinity ratio} = \frac{\text{Male population}}{\text{Total population}} \times 100$$

A masculinity proportion of 50 per cent implies a balance of the sexes.

Given the following data, complete the table below by using the formula for masculinity ratio:

Province	Male Population	Total Population	Ratio Masculinity
Henan	37,951,734	74,422,739	
Hubei	24,544,398	47,804,150	
Hunan	28,052,466	54,008,851	
Guangdong	30,512,257	59,299,220	
Guangxi	18,852,619	36,420,960	
Sichuan	51,446,784	99,713,310	
Guizhou	14,641,472	28,552,997	
Yunan	16,500,268	32,553,817	
Tibet	935,851	1,892,393	

Source: *The 1982 Population Census of China.*

B. EVALUATION

1. *Which province in the above table has the highest masculinity ratio?*

2. *Which province has the lowest masculinity ratio?*

3. *Which would be more advantageous for the economic growth of a province, a high masculinity ratio or a low masculinity ratio? Explain.*

CONTENT	:	POPULATION CHANGE: FERTILITY, MORTALITY, IN-MIGRATION, OUT-MIGRATION, RATE OF NATURAL INCREASE, AND GROWTH RATE
OBJECTIVE	:	*To develop the ability to perform the operations of addition, multiplication and their inverse operations in solving problems related to measures of population change.*
GRADE LEVEL	:	HIGH SCHOOL
SUBJECT	:	MATHEMATICS

A. Opener: Content

1. Let us study some measures of population change. This has to do with the rate of growth of a population, which is made up of four major components: *fertility, mortality, in-migration, and out-migration.* Fertility refers to the actual performance of a population in bearing children, the main measure of which is crude birth rate.

a) The crude birth rate is the number of births per 1,000 inhabitants. It is easily calculated by the following formula:

$$CBR = \frac{B}{P} \times 1{,}000$$

where

CBR = crude birth rate

B = number of live births, and

P = mid-year total population in which the births occur

Example: The number of births in Abra was 3,598 and the mid-year population was 145,508 in 1980. What was the crude birth rate for Abra that year?

Solution:

$$CBR = \frac{B}{P} \times 1{,}000$$

$$= \frac{3{,}598}{145{,}508} \times 1{,}000$$

$$= 24.7 \text{ per } 1{,}000 \text{ inhabitants}$$

(i) What is the formula for crude birth rate? Write a direct formula for B (number of live births), when CBR (crude birth rate) and P (mid-year total population) are given.

$$CBR = \underline{\qquad\qquad\qquad\qquad}$$

(ii) Compute the formula for P (mid-year total population), if CBR and BR are given.

(iii) Using the given formula in the example, or the derived formulas in examples (a) and (b), complete the following table:

Place	No. of Births	Population	Birth rate per 1,000
Manila	30,200	1,323,000	
Quezon City		1,185,000	25.4
Caloocan City	21,473	985,000	
Pasay City	24,852	872,000	
Mandaluyong	11,374		23.5

2. Look for the meaning of mortality. How does it affect population growth? The simplest measure of mortality in a population is the crude death rate, which is calculated by using this formula:

$$CDR = \frac{D}{P} \times 1{,}000$$

where

CDR = crude death rate

D = deaths in the year, and

P = mid-year population

Example: According to the Bureau of Health Report in 1969, the number of deaths in the Philippines was 248,251 and the 1969 mid-year population was 36,849,000. What was the crude death rate of the Philippines for that year?

Solution:

$$CDR = \frac{D}{P} \times 1{,}000$$

$$= \frac{248{,}251}{36{,}849{,}000} \times 1{,}000$$

$$= 6.7$$

The crude death rate of the Philippines for that year was 6.7 per 1,000 population.

Using the formulae given in the examples above, solve the following problems:

a) 1,000 people live on Soi Paideemadi. Ten children were born and three people died during the year. What is the growth rate of Soi Paideemadi?

b) 2,000 people live on Iqbal Avenue. Twenty children were born between June and December. Six people died. What is the growth rate of Iqbal Avenue?

c) 3,000 people live in Shalimar Sector. Sixteen children were born between June and December. No one died. What is the growth rate of Shalimar Sector?

d) 6,000 people live in Bang Saen. Twenty-four people died between January and June. The growth rate was 16. How many children were born in Bang Saen between January and June?

e) 1,500 people live in Tamati. Fifteen children were born between June and December. The growth rate was two. How many people died in Tamati between June and December?

3. Migration is another component of population change. What is meant by migration? The two kinds of migration are internal and international migration. Distinguish between internal and international migration. The difference between in-migration and out-migration is called net migration.

a) The net migration rate is computed by using the following formula:

$$NMR = \frac{I - O}{P} \times 1{,}000$$

where

NMR = net migration rate

IM = number of arriving migrants (in-migrants)

OM = number of departing migrants (out-migrants), and

P = mid-year population

Example: A certain country had a population of 78,544,000 in 1980. There were 15,700 immigrants and 8,900 emigrants during that year. What was the net migration rate of that country in 1980?

$$NMR = \frac{I - O}{P} \times 1{,}000$$

$$= \frac{15{,}700 - 8{,}900}{78{,}544{,}000} \times 1{,}000$$

$$= \frac{6{,}800}{78{,}544}$$

$$= .087$$

In 1982, the population of a certain Southeast Asian country was 156,382,000. During the same year there were 22,500 immigrants and 12,300 emigrants. Find the net migration rate of that country in 1982.

4. Measures of population change may be determined in several ways depending upon the data available for the purpose. If the birth rate and death rate are known, the rate of growth may be calculated by using the rate of natural increase. This is the difference between the birth rate and death rate, which is expressed by the following formula:

$$RNI = BR - DR$$

where

RNI = rate of natural increase

BR = birth rate, and

DR = death rate

Example: The birth rate of Kuwait is 47 and the death rate is 6. Find the rate of natural increase.

Solution:

RNI = BR - DR

= 47 - 6

= 41 per 1,000 or 4.1 per cent

The rate of natural increase of Kuwait is 4.1 per cent.

a) What is the rate of natural increase if the birth rate and the death rate are equal?

b) Comment on the rate of natural increase of a country whose birth rate is lower than its death rate.

5. The growth rate may be determined if the net migration is available together with the birth rate and the death rate. The following formula may be used in computing the growth rate:

GR = BR - DR + NMR or

GR = RNI + NMR

where

GR = growth rate

BR = birth rate

DR = death rate

NMR = net migration rate and

RNI = rate of natural increase

Example: The rate of natural increase of Jordan is 3.1 and the net migration rate is 2. Find the growth rate of Jordan.

Solution:

GR = RNI + NMR

= 3.1 + 0.2

= 3.3

Thus, the growth rate of Jordan is 3.3.

It is important to note that the net migration rate is 2 per 1,000 or .2 per cent.

Given the following data, complete the following table by applying the most appropriate formula for each column.

Birth Rate (BR) Per 1,000	Death Rate (DR) Per 1,000	Rate of Nat. Increase (RNI) Per 1,000	Net Migration Rate (NMR) Per 1,000	Growth Rate (GR) Per 1,000
35	10		5	
47		27	3	
	9	45	2	4.7

Adapted from: The Philippines, Department of Education and Culture Population Education Programme, *"Teacher's guide in population education for mathematics"*, First year - Second year, Manila, 1975. p. 22-28.

CONTENT	:	FAMILY SIZE AND COMPUTING AVERAGE NUMBER OF CHILDREN
OBJECTIVE	:	*To become familiar with the construction of a frequency table using data on family size.*
GRADE LEVEL:		HIGH SCHOOL
SUBJECT	:	MATHEMATICS

LESSON ONE

A. OPENER: CONTENT

The students are asked to answer the following questions:

1. What determines the size of a family?

The students may answer births, marriage, permanent visitors, etc. The purpose of this question is to begin focusing on data on the number of live children in different families.

2. What is the number of children born alive to your mother?

The students should also include any children who may have died since birth, in answering question 1. Write the figures on the blackboard as the students answer. You will have a series of figures on the blackboard, such as 4, 5, 7, 3, 2, 9 .....

3. How many families are there that have four children each? Three children each?

Let the students count 4's, 5's for a few minutes.

Is it easy to find this from the list that we wrote on the blackboard? Could you think of any other way of setting out those figures so that it would be easier to find the number of families with one child, two children, three children, etc.?

(Given some time for the students to think. If the students come out with a method, represent it on the board and discuss the method of recording the data. If not, ask further questions such as the ones given below).

What is the largest number of children born alive to a mother?

Write the number at the top of blackboard.

What is the smallest number of children born alive to a mother?

Write the figure at the bottom of blackboard. Discuss with pupils about putting the data in a tabular form. If necessary, suggest the following.

Number of children (n)	Tallying of families having the number of children stated in Column 1	Frequency (f)
9	1	1
8	1111	4
7	𝍸 11	7
6	𝍸 𝍸	10
5	𝍸 𝍸 1	11
4	𝍸 111	8
3	𝍸 11	7
2	1	1
1	1	1
		Σf50

Introduce the idea of the "gate technique' of tallying in fives as shown in the table above, and the 'Σ' sign which denotes the sum of all the figures in the column.

Does the table help us to tell quickly the numbers of families with different numbers of children?

Tell the students that this kind of table is called a "frequency" table.

4. How many children do you expect to have when you yourselves become parents?

(Give the students enough time to think and write the figures on the blackboard. Have students copy these in their worksheet).

B. Evaluation

Prepare a frequency table on the data you copied in the class. Additional exercises of a similar kind may be given to the pupils. These and the frequency tables above may be utilized for the next lesson.

LESSON TWO

A. Objective

To help the pupils understand the "mode" and acquire the skill in computing the arithmetical mean and average from given data or from a frequency table.

B. Procedures

1. Write a pupil's frequency distribution on the blackboard

   What is the most frequently occurring value in respect of the expected number of children?

   What is the least frequently occurring value in respect of the expected number of children?

   What can we say by looking at the most frequently occurring value?

   (Many of you seem to have settled on having that number of children. Tell the pupils that the most frequently occurring value is called the "mode". When there is a range, say 4-6 children, the mid-point of the range, i.e. 5 is usually taken as the "mode". Circle the "mode" in the table. The occurrence of one or a few extremely high (or low) values has no effect on the mode).

2. How can we describe the characteristics of the group - here the class preference for a certain number of children?

   Here, pupils need to be reminded that the average (arithmetical mean) value represents the central tendency of the characteristics of the whole group. Elicit from pupils the method of calculating the average value.

   How can we calculate the total number of children?

Multiply the number of children by the frequency. As for instance, if there are four responses, i.e. F = 4, to the category of 8 children, the total number of children in that category will be 4 x 8 = 32 children.

What is the next step to get the average?

Divide the total number of children by the total number of families. This gives the average. Complete the table with pupil participation, as shown below.

No. of children (X)	Tallying	f	Xf
9		1	9
8		4	32
7		7	49
6		10	60
5		11	55
4		8	32
3		7	21
2		1	2
1		1	1
		$\Sigma f=50$	$\Sigma Xf=261$

Average $(\bar{X}) = \frac{Xf}{f}$

$= \frac{261}{50}$

$= 5.2$

Tell the pupils what we call the average, "Arithmetical Mean", or simply "Mean". Mean is written as X. The Mean is a measure of the Central Tendency. It is representative of the measurement of a group as a whole with respect to certain traits. The Arithmetical Mean should be thought of as a computed value and not as a value which actually exists.

How does "Mean" help us to describe the characteristics of the group?

C. Evaluation

1. *Mean and mode computation on the other frequency distributions. What does the mean indicate? Give possible reasons.*

2. *Additional exercises of a similar kind such as the following may be given to the pupils, as home assignments.*

Read and solve the following problem:

a) *In a village in Thailand, five families have three children each, four families have two children each, 10 families have four children each, 10 families have five children each, four families have six children each, three families have one child each and four families have no child. What is the average number of children per family in Bang Saen Village?*

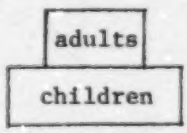
Adapted from: Unesco. Regional Office for Education in Asia. *"Population and family education draft sample instructional materials - science/mathematics".* Bangkok, 1971, p. 34-37.

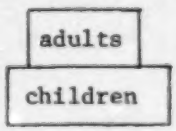
CONTENT	:	POPULATION COMPOSITION: DEPENDENCY RATIO
OBJECTIVES	:	1. *To define dependency ratio, and compare and interpret dependency ratios of different countries.* 2. *To be able to solve problems involving dependency ratio concept.*
GRADE LEVEL:		HIGH SCHOOL
SUBJECT	:	MATHEMATICS

A. READING AND ACTIVITIES FROM STUDENT TEXT

The people in any population have different ages. In fast-growing populations, there are more children than adults.

large families, many children compared to number of adults





smaller families fewer children compared to number of adults

Fast population growth Slow population growth

One way of describing the ages of people in a population is the dependency ratio. It is based on the fact that all people - very young, adults, very old - are consumers. But only some people are producers. The dependency ratio describes the part of the population who are not working and therefore depend on those who are working. To be more exact, demographers call the non-working age groups; those aged 0 to 14, too young to work and those aged 65 and above too old to work. They define the dependency ratio as the number of people 65 and over and under 15 in relation to those aged 15 to 64.

$$\text{dependency ratio} = \frac{\text{number of people under 15 years + number of people 65 years and over}}{\text{number of people 15 to 64 years}} \times 100$$

(we multiply by 100 to show the number per 100 people).

The dependency ratio of Sri Lanka (in 1972) was 82. This means that 100 people in the working ages must support themselves plus 82 others.

B. EXERCISES:

1. *The dependency ratio of the United Kingdom (in 1972) was 59. This means that, on the average, each 100 people in the working ages had to support themselves plus _____ others. (Fill in the blank space).*

2. *For Malaysia (in 1972) for each 100 people, on the average, there were: 42 people under 15 years*

   54 people aged 15 to 64

   4 people aged 65 and over.

   What was the dependency ratio?

3. *Here are the dependency ratios for five countries (in 1983). In what country do the working age people have to support the greatest number of others? In what country do the working age people have to support the fewest non-working people?*

Country	Dependency ratio (in 1983)	Country	Dependency ratio (in 1983)
Japan	32	China	38
Republic of Korea	37	Viet Nam	44
United Kingdom	35	Pakistan	48
Malaysia	43	Bangladesh	48
Sri Lanka	39	India	42

4. *The following table shows the dependency ratio for selected developing and developed countries of the world. Study the first few entries in the table carefully and then fill up the blanks.*

Dependency Ratio of Selected Countries (in 1983)*

Name of the country	Dependency Ratio		
		Age group percentage	
		youth	old-age
	Total	0-14 yrs.	65 and above
A. Developing countries			
Afghanistan	47	45	2
Bhutan	45	42	3
Iran	48		3
Nepal	45	42	
Burma	45		4
Laos		42	3
Namibia	47		3
Swaziland	49	46	
B. Developed countries			
Japan	32	23	
Canada	32		9
United States		23	11
Denmark	35		15
Sweden	36	19	
United Kingdom		20	15
France	35		13
West Germany	31	17	

a) which of two categories of the countries (developing or developed) have more favourable earner - dependency ratio and why?

b) which group of the countries have higher ratio of young population and why?

c) the census data of a village in India showed that the residents of the village fall in the following age categories:

* 1983 World Population Data Sheet of the Population Reference Bureau, Inc., Washington D.C., U.S.A.

Age of residents	Frequency
0 - 5	50
6 - 10	42
11 - 14	37
15 - 20	35
21 - 25	30
26 - 30	25
31 - 35	24
36 - 40	20
41 - 45	18
46 - 50	16
51 - 55	12
56 - 60	10
61 - 64	5
65 and above	3

d) what was the dependency ratio in this village? Also explain the reasons for high percentage of young population in the village!

Adapted from: Malaysia. Curriculum Development Centre. Population Education Project. *"Teacher's guide to population education in civics, forms 4 and 5."* Kuala Lumpur, 1975, p. 3-6.

CONTENT	:	POPULATION PROJECTION AND DOUBLING TIME
OBJECTIVES	:	1. *To become familiar with the use of per cent in solving problems related to population projection and doubling time.* 2. *To be able to solve problems involving population projections and doubling time.*
GRADE LEVEL:		HIGH SCHOOL
SUBJECT	:	MATHEMATICS

A. Opener: Content

1. Population projection

Population projection is an estimate of the future population which assumes that present or recent levels (amounts of rate) of growth will continue. To prepare a projection of the total population, the application of mathematical formulae directly to the population from one or more censuses is involved. There are different ways of making population projections.

One method is illustrated below:

In 1982 the total population of the Philippines was 50,779,000 and the growth rate was 2.47 per cent. Assuming that the growth rate is constant during the period from 1982 to 1985, find the yearly population during these years.

Total population for 1982 = 50,779,000
Growth rate = 2.47 per cent
Increase from 1982 to 1983 = 50,779,000 x .0247 (2.47%)
= 1,254,241
Add the increase to the total population for 1982
= 50,779,000 + 1,254,241
= 52,033,241

Total population for 1983 = 52,033,241
Growth rate = 2.47 per cent
Increase in population from 1983 to 1984
= 52,033,241 x .0247
= 1,285,221
Add the increase to the total population of 1983, to obtain the base population for 1984
= 52,033,241 + 1,285,221
= 53,318,462

2. Doubling time

Doubling time is another measure of population change. The population doubling time is equivalent to the number of years it takes for a population to double itself. It is usually calculated assuming that the growth rate stays constant. It is observed that countries with 1 per cent rate of growth usually double their population in 70 years; those with 2 per cent of growth in 35 years; those with 3 per cent rate of growth in 23 years; and those with 4 per cent rate of growth in 17 years. It can however be calculated using the following formula:

$$DT = 70/GR$$

where

DT = doubling time
GR = growth rate

(The equation DT = 70/GR is derived from a calculus formula. If you deposit money in the bank at an interest rate of 5 per cent per annum, it will double itself in 14 years "70/5 = 14 years". This is known as the law of 70).

a) *If the growth rate of Sri Lanka is 1 per cent how many years will it take to double its population?*

b) *If the United States of America will take 95 years to double its population, what is its growth rate?*

c) *The following table was to provide information about the country's rate of population growth and the number of years which it would take to double its population. However, some of its columns are incomplete. You are instructed to go through the table and fill up the blanks by using the doubling time formula (DT = 70/GR)?*

Country	Rate of Growth	Number of years to double population (approximate)
Afghanistan	0.04	
Bangladesh		26
Bhutan		34
India	1.99	
Iran	2.97	
Nepal		30
Pakistan	3.08	
Japan		102
Philippines	2.47	
Republic of Korea	1.57	
Socialist Rep. of Viet Nam	2.12	
Thailand		36

Source: *1982 ESCAP Population Data Sheet.*